a tube and a flat membrane. In certain aspects, the material includes one or a plurality of Nafion beads. In certain aspects, the water buffering component includes a mechanism to adjust an amount of the material in the gas flow line, for example, the mechanism may be configured for dynamic adjustment of an amount of the material in the gas flow line.

**[0010]** In certain aspects, the gas exchange measurement system is a leaf porometer. In certain aspects, the sample includes a photosynthesis and/or transpiration capable material. In certain aspects, the first water vapor sensor includes one of a capacitive sensor, a resistive sensor, a thermal-conductivity-based sensor, or an optical absorption gas analyzer (e.g., NDIR or laser-based) or a laser-based gas analyzer and wherein the second water vapor sensor includes one of a capacitive sensor, a resistive sensor, a thermal-conductivity-based sensor, or an optical absorption gas analyzer or a second laser-based gas analyzer. The first and second water vapor sensors may be of the same type or of a different type.

**[0011]** According to another embodiment, a method of buffering water content in a gas exchange measurement system is provided. The method typically includes providing an incoming airstream to a first water vapor sensor, and buffering water vapor content in the incoming airstream using a water buffering component that absorbs or desorbs water in the presence of a water concentration gradient, whereby fluctuations in water vapor content in the incoming airstream are slowed for the first water vapor sensor and other components downstream from the water buffering component in the gas exchange measurement system.

**[0012]** In certain aspects, the first water vapor sensor is configured to measure a first concentration value of water vapor in the airstream entering a sample chamber, and the other components downstream of the water buffering component include at least the sample chamber, which is configured to hold a sample capable of adding or removing water from the airstream, and a second water vapor sensor configured to measure a second concentration value of water vapor in the airstream exiting the sample chamber.

**[0013]** In certain aspects, the first water vapor sensor is configured to measure a first concentration value of water vapor in the airstream exiting the water buffering component, and wherein the other components downstream of the water buffering component include at least: the sample chamber, configured to receive the airstream exiting the water buffering component and to hold a sample capable of adding or removing water from the airstream, and a second water vapor sensor configured to measure a second concentration value of water vapor in the airstream exiting the sample chamber.

**[0014]** In certain aspects, the method further includes continuously measuring the first water vapor concentration with the first water vapor sensor and continuously measuring the second water vapor concentration with the second water vapor sensor as the airstream continuously flows through or by the water buffering component, the first water vapor sensor, the sample chamber and the second water vapor sensor.

**[0015]** In certain aspects, the water buffering component includes a Nafion material. In certain aspects, the Nafion material has a structure selected from the group consisting of a bead, a tube and a flat membrane. In certain aspects, the water buffering component includes one or a plurality of Nafion beads.

**[0016]** In certain aspects, the method further includes adjusting an amount of surface area of the Nafion material exposed to the incoming airstream. For example, adjusting an amount of surface area may include removing beads or adding additional beads, changing a shape of a Nafion structure, adding or removing tubes, unrolling a rolled Nafion structure, etc.

**[0017]** According to an embodiment, a gas exchange analysis system is provided that includes an analyte buffering component, the analyte buffering component including a material configured to buffer a first analyte in a flow of a gas, whereby fluctuations in the first analyte content in the flow of the gas are reduced or slowed for components downstream from the analyte buffering component in the gas exchange system, wherein the components downstream of the analyte buffering component include: a analyte sensor configured to receive the flow of the gas from the analyte buffering component and configured to measure a first concentration of a target analyte in the gas, a sample chamber configured to hold a sample capable of adding or removing the analyte from the gas entering the sample chamber, and to 1) receive the gas exiting the first analyte sensor, or 2) receive the flow of the gas from the analyte buffering component, and a second analyte sensor configured to measure a second concentration of the target analyte in the gas exiting the sample chamber. In certain aspects, the analyte includes water and the material selectively absorbs or desorbs water in the presence of a water concentration gradient.

**[0018]** As used herein, adding water content or removing water content from an air stream may include outgassing, desorbing, a chemical reaction, a metabolic reaction, or other mechanisms for generating water content.

**[0019]** In certain aspects, a sample may include any material, substance or organism that exchanges, generates or consumes water. In certain aspects, the sample may include a water saturable or aqueous sample, which may include a photosynthesis capable material, substance or organism, such as a leaf or algae, or may include a respiratory material, substance or organism, e.g., a material that respires, or may include a metabolically active material, substance or organism.

**[0020]** In a further embodiment, a non-transitory computer readable medium is provided that stores instructions, which when executed by one or more processors, cause the one or more processors to implement a method of measuring a concentration of water vapor, and computing relevant variables such as transpiration and stomatal conductance, in a gas using a gas exchange measurement system as described herein.

**[0021]** Reference to the remaining portions of the specification, including the drawings and claims, will realize other features and advantages of the present invention. Further features and advantages of the present invention, as well as the structure and operation of various embodiments of the present invention, are described in detail below with respect to the accompanying drawings. In the drawings, like reference numbers indicate identical or functionally similar elements.

## BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

**[0022]** The detailed description is described with reference to the accompanying figures. The use of the same